

Laparoscopic Management of Iatrogenic Lesions

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Abstract

Purpose: To present our series of patients who underwent laparoscopic correction of iatrogenic lesions and a review of the literature.

Patients and Methods: We evaluated 23 patients who underwent laparoscopic correction of iatrogenic lesions. Thirteen patients had open surgery, 6 had an endoscopic procedure, and 4 had a laparoscopic approach as the first surgical procedure. Vesicovaginal fistulas (VVF) developed in seven patients after open abdominal hysterectomies, and 1 patient presented with a VVF after ureterolithotripsy. A urethral cutaneous fistula developed in one patient after a laparoscopic resection of endometriosis nodules, and 1 patient presented with a ureterovaginal fistula after a perineoplasty. Three patients presented with encrusted ureteral stents after ureterolithotripsy. Ureteral stenosis developed in seven patients: three after open abdominal surgery, three after ureteroscopy, and one after pyeloplasty. One patient had a ureteral injury during laparoscopic partial nephrectomy, and two patients had bowel injuries after a tension-free vaginal tape procedure and a laparoscopic radical prostatectomy.

Results: All patients underwent laparoscopic correction of the iatrogenic injuries. One patient had an early recurrence of a VVF, and one patient had a recurrence of a ureteral stenosis. There was one conversion to open surgery because of technical difficulties and one major bleeding event that necessitated blood transfusion. A lower limb compartmental syndrome developed in one patient.

Conclusion: Despite the small number of patients and different types of surgeries performed, laparoscopic management of iatrogenic lesions seems to be feasible and safe in experienced hands. Its precise role in the management of this stressful condition still needs to be determined.

Introduction

ADVERSE EVENTS occur with some frequency in urologic practice. The complication rates for urologic laparoscopy vary significantly from one series to another, ranging from 3.6% to 22.1%.^{1,2} The different procedures assessed, different degrees of technical difficulty, and different ways to classify complications may explain such a disparity.^{3–5} Nevertheless, it seems that laparoscopic procedures have complication rates that are comparable to those of open surgeries.^{6–9}

In some laparoscopic series, reintervention was necessary in 0.7% to 1.5% of the cases,^{1,10} and it was usually associated with technical difficulties, such as adhesions and anatomic

structures displacement, particularly when the patient previously had open surgery. Reoperation is always a stressful condition for patients and surgeons, and it carries the spectrum of medical malpractice issues. Malpractice premiums have increased by up to 57% for urologists in recent years,¹¹ and surgical procedures were the greatest generator of claims.^{11,12}

Video laparoscopy raised the possibility of minimizing surgical morbidity for a variety of conditions; however, to our knowledge, there are no previous reports that address the role of laparoscopy in the correction of surgical complications. We present our series of patients who underwent laparoscopic correction of iatrogenic lesions and a review of the literature.

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Patients and Methods

Twenty-three patients who underwent laparoscopic correction of iatrogenic lesions were evaluated (Table 1). Thirteen patients had open surgery, 6 had an endoscopic procedure, and 4 had a laparoscopic approach as the first surgical procedure.

Vesicovaginal fistula (VVF) developed in seven patients after open abdominal hysterectomy (for benign conditions in five patients and cancer in two patients) and VVF developed in one patient after ureterolithotripsy. All fistulas were located above the bladder trigone. Four of these eight patients had undergone previous surgical attempts to manage the fistula, including endoscopic fulguration of the fistulous tract in one patient, vaginal repair in one patient, and open abdominal repair in two patients.

A ureterocutaneous fistula developed in one patient after endometriotic nodules resection, and an ureterovaginal fistula developed in one patient after perineoplasty. Both patients underwent laparoscopic ureteral reimplantation.

Three patients presented with encrusted ureteral stents secondary to endoscopic management of urinary stones. We were unable to determine the time elapsed from the placement of the ureteral stents to their encrustation because these patients were primarily treated at other institutions. All patients underwent transperitoneal laparoscopic pyelotomy to retrieve the encrusted stent.

Seven patients presented with ureteral strictures after ureterolithotripsy (3), laparoscopic pyeloplasty (1), colon resection for cancer (1), gunshot wound (1), and open hysterectomy (1). Uretero-uretero anastomosis was the only procedure performed in the four first patients. The last two patients needed only ureterolysis while the patient who un-

derwent a colon resection underwent ureterolysis and ureteral reimplantation.

One patient with a nonfunctioning upper pole had a ureteral injury during a left partial nephrectomy with transection of the lower pole unit ureter. The injury was promptly recognized and managed with ureteroureterostomy and stent placement.

An enterocutaneous fistula developed in one patient after a laparoscopic radical prostatectomy; the fistula was managed with laparoscopic bowel resection and anastomosis.

During a tension-free vaginal tape procedure for urinary incontinence, one patient had a bowel perforation that was not identified at the time of surgery. Diagnostic laparoscopy was performed to identify and perform primary closure of the bowel perforation.

Results

All patients underwent laparoscopic correction of the iatrogenic injuries. Two failures (8.6%) ensued. One patient had an early recurrence of VVF after removal of the bladder catheter. One patient had an ureteral restenosis after ureteroureterostomy and was lost of follow-up.

We had one conversion (4.3%) to open surgery during a VVF correction because of intense fibrosis. This patient had had two previous open surgeries: an abdominal hysterectomy for leiomyoma 37 years previously and a simple left nephrectomy for renal exclusion and recurrent urinary tract infection 8 years previously. After an ureteroscopy and placement of a ureteral stent for stones, a VVF developed. This patient is also the only one who needed a blood transfusion.

TABLE 1. FIRST SURGERIES, SURGICAL COMPLICATIONS, AND LAPAROSCOPIC PROCEDURES IN PATIENTS WITH IATROGENIC INJURIES

Patient #	First surgery	Complication	Laparoscopic procedure
1	Hysterectomy	VVF	Correction
2	Hysterectomy	VVF	Correction
3	Hysterectomy	VVF	Correction
4	Hysterectomy	VVF	Correction
5	Hysterectomy	VVF	Correction
6	Hysterectomy	VVF	Correction
7	Hysterectomy	VVF	Correction
8	Ureterolithotripsy	VVF	Correction (conversion)
9	Laparoscopic Endometriotic nodules resection	Ureterocutaneous fistula	Ureteral reimplantation
10	Perineoplasty	Ureterovaginal fistula	Ureteral reimplantation
11	Ureterolithotripsy	Encrusted ureteral stent	Pyelotomy and stent removal
12	Ureterolithotripsy	Encrusted ureteral stent	Pyelotomy and stent removal
13	Open pyelolithotomy	Encrusted ureteral stent	Pyelotomy and stent removal
14	Ureterolithotripsy	Ureteral stenosis	Ureteroureterostomy
15	Ureterolithotripsy	Ureteral stenosis	Ureteroureterostomy
16	Ureterolithotripsy	Ureteral stenosis	Ureteroureterostomy
17	Laparoscopic pyeloplasty	Ureteral stenosis	Ureteroureterostomy
18	Colon resection	Ureteral stenosis	Ureterolysis and reimplantation
19	GSW	Ureteral stenosis	Ureterolysis
20	Hysterectomy	Ureteral stenosis	Ureterolysis
21	Laparoscopic partial nephrectomy	Ureteral injury	Ureteroureterostomy
22	Laparoscopic radical prostatectomy	Enterocutaneous fistula	Bowel resection and anastomosis
23	TVT	Bowel perforation	Primary closure

VVF = vesicovaginal fistula; GSW = gunshot wound; TVT = tension-free vaginal tape.

In another patient who underwent a VVF correction, a lower limb compartmental syndrome developed that was associated with deep vein thrombosis (DVT). Risk factors for DVT in this patient were the prolonged operative time (390 minutes), body mass index (30), hypothyroidism, and the lithotomy position for an associated pubovaginal sling for urinary stress incontinence.

Discussion

The widespread use of the laparoscopic approach in urology has led to increasingly liberal grounds for indication of this operative technique. More and more open surgical procedures have been in competition with or even superseded by their laparoscopic counterpart. There is some concern, however, about laparoscopic management of iatrogenic lesions. Extensive previous abdominal or pelvic surgery and pelvic fibrosis are considered relative contraindications to laparoscopic surgery.¹³

Abdominal hysterectomy remains the most common cause of VVF, occurring in 1/1800 hysterectomies¹⁴ and accounting for about 85% of cases; radiation (10%) and obstetric injury (5%) are the other major causes.¹⁵ In terms of the best surgical approach, the arguments continue as to whether the abdominal or the vaginal route is better for VVF repair. So far, there are no significant statistical data to answer which one is better.

The vaginal approach seems to be easy, safe, and quicker for most early simple fistulas,¹⁶ while the abdominal approach may be indicated to address supratrigonal VVFs¹⁷ or more complex fistulas, such as those that result from radiation therapy with small capacity bladders.¹⁸ Although the surgical results are mainly related to the cause of the fistula and the experience of the surgeon, failure rates range from 4% to 37%, according to the surgical approach: open abdominal or vaginal techniques.¹⁹

The laparoscopic repair of a VVF may offer the patient the advantages of a shorter hospital stay, more rapid postoperative recovery, and better cosmetic results than the traditional abdominal approach. Laparoscopy also allows excellent magnification and exposure of the pelvic structures, providing fast and direct access to the fistula and avoiding anterior cystotomy or bipartition of the bladder, as in the O'Connor procedure.¹⁷ It also allows resection of the fistulous tract.

Failure rates range from 0% to 8% for the laparoscopic approach.²⁰⁻²² In our series, four of eight (50%) patients had previously undergone unsuccessful open surgery to correct the VVF; this made fistulous tract recognition more difficult because of excessive tissue scarring. We had one conversion (11%) and one failure (12.5%) in the laparoscopic repair of VVF. Laparoscopic freehand intracorporeal suturing, particularly in the pelvis, can be cumbersome, and continuous training and practice are mandatory to perform this type of surgery.

Injury to the ureter is a potential complication of any difficult abdominopelvic surgical procedure, whether gynecologic, obstetric, general surgical, or urologic. The incidence varies between 0.5% and 10% in most series.^{23,24} Gynecologic surgery has been the traditional cause of more than 50% of iatrogenic ureteral injuries, followed by general surgical procedures.²⁵⁻²⁷ In the last 10 to 15 years, however, with the increase in complex minimally invasive endoscopic proce-

dures, such as ureteroscopy, ureterolithotripsy, and endopyelotomy, urologic procedures now account for most incidences of ureteral injuries.²⁸⁻³²

Most of the urologic ureteral injuries are identified intraoperatively and are corrected promptly.²⁹ Management of ureteral injuries can be accomplished by several endoscopic techniques, such as balloon dilation and endoureterotomy. Results vary, however, according to the stricture cause, location, and length, and renal function.

Late detected injuries necessitate more procedures to repair the ureter and have worse results.^{25,29,33,34} Overall success rates range from 48% to 88% for balloon dilation, 55% to 85% for endoureterotomy, and 91% to 97% for conventional open surgery.³⁵ In our series of 10 patients, laparoscopic management of early (6) and late (4) detected ureteral injuries was accomplished in all cases but one (success rate, 90%) despite the fact that it was a uretero-uretero anastomosis, ureterolysis, or ureteral reimplantation.

Encrustation, one of the most serious complications of ureteral stents, is well documented in the literature.³⁶⁻⁴² Mean time from insertion of the ureteral stent to encrustation is about 6 months. Known risk factors for stent encrustation are long indwelling time, urinary sepsis, history of or concurrent stone disease, chemotherapy, pregnancy, chronic renal failure, and metabolic or congenital abnormalities.³⁸⁻⁴¹

Management of encrusted stents may necessitate multiple approaches. First-line options are extracorporeal shockwave lithotripsy (SWL), ureteroscopy, and percutaneous nephrolithotomy; however, frequently more than one procedure is needed. The amount of encrustation is another factor that influences the therapeutic approach.⁴³

Laparoscopy emerges as a minimally invasive option to manage stent encrustation. Bhansali and associates⁴⁴ described laparoscopic management of a heavily encrusted ureteral stent. In our series, we managed three cases of heavily encrusted stents with laparoscopic pyelotomy, after repeated failure of SWL.

Bowel injuries during minimally invasive procedures may be difficult to diagnose. Signs and symptoms may not be readily recognized in some cases. Laparoscopy may provide early diagnosis and management when bowel injury is suspected.⁴⁵ Late recognized injuries can also be managed laparoscopically.⁴⁶ Our two patients received an early diagnosis and were treated by the laparoscopic approach.

Improvements in video technology, endoscopic instruments, and laparoscopic skills, particularly intracorporeal suturing, have allowed surgeons to expand their repertoire of minimally invasive procedures. This minimal access approach has the potential to minimize postoperative pain, shorten hospital stay, and speed convalescence. Compared with other types of minimally invasive procedures, laparoscopy has the advantage of reproducing the open technique.

Despite the small number of patients and different types of surgeries performed, laparoscopic management of iatrogenic lesions seems to be feasible and safe in experienced hands. Its precise role in the management of this stressful condition still needs to be determined.

References

1. Vallancien G, Cathelineau X, Baumert H, Doublet JD, Guillonnet B. Complications of transperitoneal laparoscopic

- surgery in urology: Review of 1,311 procedures at a single center. *J Urol* 2002;168:23–26.
2. Permpongkosol S, Link RE, Su LM, Romero FR, Bagga HS, Pavlovich CP, Jarrett TW, Kavoussi LR. Complications of 2,775 urological laparoscopic procedures: 1993 to 2005. *J Urol* 2007;177:580–585.
 3. Clavien PA, Sanabria JR, Strasberg SM. Proposed classification of complications of surgery with examples of utility in cholecystectomy. *Surgery* 1992;111:518–526.
 4. Dindo D, Demartines N, Clavien PA. Classification of surgical complications: A new proposal with evaluation in a cohort of 6336 patients and results of a survey. *Ann Surg* 2004;240:205–213.
 5. Guillonneau B, Abbou CC, Doublet JD, Gaston R, Janetschek G, Mandressi A, Rassweiler JJ, Vallancien G. Proposal for a “European Scoring System for Laparoscopic Operations in Urology”. *Eur Urol* 2001;40:2–7.
 6. Kavoussi LR, Sosa E, Chandhoke P, et al. Complications of laparoscopic pelvic lymph node dissection. *J Urol* 1993;149:322–325.
 7. Gill IS, Kavoussi LR, Clayman RV, et al. Complications of laparoscopic nephrectomy in 185 patients: A multi-institutional review. *J Urol* 1995;154:479–483.
 8. Rassweiler J, Fornara P, Weber M, et al. Laparoscopic nephrectomy: The experience of the laparoscopic working group of the German Urological Association. *J Urol* 1998;160:18–21.
 9. Brunt LM, Doherty GM, Norton JA, Soper NJ, Quasebarth MA, Moley JF. Laparoscopic adrenalectomy compared to open adrenalectomy for benign adrenal neoplasms. *J Am Coll Surg* 1996;183:1–10.
 10. Parsons JK, Varkarakis I, Rha KH, Jarrett TW, Pinto PA, Kavoussi LR. Complications of abdominal urologic laparoscopy: Longitudinal five-year analysis. *Urology* 2004;63:27–32.
 11. Sobel DL, Loughlin KR, Coogan CL. Medical malpractice liability in clinical urology: A survey of practicing urologists. *J Urol* 2006;175:1847–1851.
 12. Perrotti M, Badger W, Prader S, Moran ME. Medical malpractice in urology, 1985 to 2004: 469 consecutive cases closed with indemnity payment. *J Urol* 2006;176:2154–2157.
 13. Gill IS, Kerbl K, Meraney AM, et al. Basics of laparoscopic urologic surgery. In: Walsh PC, Retik AB, Vaughan ED, Wein AJ, Kavoussi LR, Novick AC, Partin AW, Peters CA, eds. *Campbell’s Urology*. Philadelphia: WB Saunders, 2002, pp 3457–3458.
 14. Miller EA, Webster GD. Current management of vesicovaginal fistulae. *Curr Opin Urol* 2001;11:417–421.
 15. Symmonds RE. Incontinence: Vesical and urethral fistulas. *Clin Obstet Gynecol* 1984;27:499–514.
 16. Goodwin WE, Scardino PT. Vesicovaginal and ureterovaginal fistulas: A summary of 25 years of experience. *J Urol* 1980;123:370–374.
 17. O’Connor VJ Jr, Sokol JK, Bulkley GJ, Nanninga JB. Suprapubic closure of vesicovaginal fistula. *J Urol* 1973;109:51–54.
 18. Blaivas JG, Heritz DM, Romanzi LJ. Early versus late repair of vesicovaginal fistulas: Vaginal and abdominal approaches. *J Urol* 1995;153:1110–1113.
 19. Nesrallah LJ, Srougi M, Gittes RF. The O’Connor technique: The gold standard for supratrigonal vesicovaginal fistula repair. *J Urol* 1999;161:566–568.
 20. Sotelo R, Mariano MB, García-Segui A, et al. Laparoscopic repair of vesicovaginal fistula. *J Urol* 2005;173:1615–1618.
 21. Chibber PJ, Shah HN, Jain P. Laparoscopic O’Connor’s repair for vesico-vaginal and vesico-uterine fistulae. *BJU Int* 2005;96:183–186.
 22. Nagraj HK, Kishore TA, Nagalaksmi S. Early laparoscopic repair for supratrigonal vesicovaginal fistula. *Int Urogynec J Pelvic Floor Dysfunct* 2007;18:759–762.
 23. Bright TC III, Peters PC. Ureteral injuries secondary to operative procedures: Report of 24 cases. *Urology* 1977;9:22–26.
 24. Neuman M, Eidelman A, Langer R, Golan A, Bukovsky I, Caspi E. Iatrogenic injuries to the ureter during gynecologic and obstetric operations: *Surg Gynecol Obstet* 1991;173:268–272.
 25. Flynn JT, Tiptaft RC, Woodhouse CR, Paris AM, Blandy JP. The early and aggressive repair of iatrogenic ureteric injuries. *Br J Urol* 1979;51:454–457.
 26. Hughes ES, McDermott FT, Polglase AL, Johnson WR. Ureteric damage in surgery for cancer of the large bowel. *Dis Colon Rectum* 1984;27:293–295.
 27. Dowling RA, Corriere JN Jr, Sandler CM. Iatrogenic ureteral injury. *J Urol* 1986;135:912–915.
 28. Assimos DG, Patterson LC, Taylor CL. Changing incidence and etiology of iatrogenic ureteral injuries. *J Urol* 1994;152:2240–2246.
 29. Selzman AA, Spirnak JP. Iatrogenic ureteral injuries: A 20-year experience in treating 165 injuries. *J Urol* 1996;155:878–881.
 30. Stoller ML, Wolf JS Jr. Endoscopic ureteral injuries. In: McAninch JW, ed. *Traumatic and Reconstructive Urology*. Philadelphia: WB Saunders Co, 1996, 199–212.
 31. Preston JM. Iatrogenic ureteric injury: Common medicolegal pitfalls. *BJU Int* 2000;86:313–317.
 32. Meng MV, Freise CE, Stoller ML. Expanded experience with laparoscopic nephrectomy and autotransplantation for severe ureteral injury. *J Urol* 2003;169:1363–1367.
 33. Blandy JP, Badenoch DF, Fowler CG, Jenkins BJ, Thomas NW. Early repair of iatrogenic injury to the ureter or bladder after gynecological surgery. *J Urol* 1991;146:761–765.
 34. Al-Awadi K, Kehinde EO, Al-Hunayan A, Al-Khayat A. Iatrogenic ureteric injuries: Incidence, aetiological factors and the effect of early management on subsequent outcome. *Int Urol Nephrol* 2005;37:235–241.
 35. Hafez KS, Wolf JS Jr. Update on minimally invasive management of ureteral strictures. *J Endourol* 2003;17:453–464.
 36. Mohan-Pillai K, Keeley FX Jr, Moosa SA, Smith G, Tolley DA. Endourological management of severely encrusted ureteral stents. *J Endourol* 1999;13:377–379.
 37. Borboroglu PG, Kane CJ. Current management of severely encrusted ureteral stents with a large associated stone burden. *J Urol* 2000;164:648–650.
 38. Monga M, Klein E, Castañeda-Zúñiga WR, Thomas R. The forgotten indwelling ureteral stent: A urological dilemma. *J Urol* 1995;153:1817–1819.
 39. Singh I, Gupta NP, Hemal AK, Aron M, Seth A, Dogra PN. Severely encrusted polyurethane ureteral stents: Management and analysis of potential risk factors. *Urology* 2001;58:526–531.
 40. Schulze KA, Wettlaufer JN, Oldani G. Encrustation and stone formation: Complication of indwelling ureteral stents. *Urology* 1985;25:616–619.
 41. Spirnak JP, Resnick MI. Stone formation as a complication of indwelling ureteral stents: A report of 5 cases. *J Urol* 1985;134:349–351.

42. Somers WJ. Management of forgotten or retained indwelling ureteral stents. *Urology* 1996;47:431–435.
43. Lam JS, Gupta M. Tips and tricks for the management of retained ureteral stents. *J Endourol* 2002;16:733–741.
44. Bhansali M, Patankar S, Dobhada S. Laparoscopic management of a retained heavily encrusted ureteral stent. *Int J Urol* 2006;13:1141–1143.
45. Hansen AJ, Tessier DJ, Anderson ML, Schlinkert RT. Laparoscopic repair of colonoscopic perforations: Indications and guidelines. *J Gastrointest Surg* 2007;11:655–659.
46. Sotelo R, Garcia A, Yaime H, Rodríguez E, Dubois R, Andrade RD, Carmona O, Finelli A. Laparoscopic rectovesical fistula repair. *J Endourol* 2005;19:603–607.
47. Sotelo R, Mirandolino M, Trujillo G, et al. Laparoscopic repair of rectourethral fistulas after prostate surgery. *Urology* 2007;70:515–518.

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Abbreviations Used

DVT = deep vein thrombosis
SWL = shockwave lithotripsy
VVF = vesicovaginal fistula

